

**PSEG Nuclear LLC**

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**JUN 06 2011**

10CFR50.73

LR-N11-0160

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington DC 20555-001

LER 272/2011-003  
Salem Nuclear Generating Station Unit 1  
Facility Operating License Number DPR-70  
NRC Docket Number 50-272

Subject: Manual Reactor Trip Due to Degraded Condenser Heat Removal

This Licensee Event Report, "Manual Reactor Trip Due to Degraded Condenser Heat Removal" is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR50.73(a)(2)(iv)(A).

The attached LER contains no commitments. Should you have any questions or comments regarding this submittal, please contact Mr. E. H. Villar at 856-339-5456.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Fricker", written over the printed name.

Carl J. Fricker  
Site Vice President - Salem

Attachments (1)

JE22  
HLL

JUN 06 2011

cc        Mr. W. Dean, USNRC - Administrator - Region I  
          Mr. R. Ennis, USNRC - Licensing Project Manager - Salem  
          USNRC Senior Resident Inspector - Salem (X24)  
          Mr. P. Mulligan, NJBNE Manager IV  
          Mr. H. Berrick, Salem Commitment Tracking Coordinator  
          Mr. L. Marabella, Corporate Commitment Tracking Coordinator

## LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to [infocollects.resource@nrc.gov](mailto:infocollects.resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

## 1. FACILITY NAME

Salem Generating Station - Unit 1

## 2. DOCKET NUMBER

05000272

## 3. PAGE

1 of 5

## 4. TITLE

Manual Reactor Trip Due to Degraded Condenser Heat Removal

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	21	2011	2011	0 0 3	0	06	06	2011		DOCKET NUMBER

## 9. OPERATING MODE

1

## 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)

- |   |   |  |  |
|---|---|--|--|
| <input type="checkbox"/> 20.2201(b)         | <input type="checkbox"/> 20.2203(a)(3)(i)   | <input type="checkbox"/> 50.73(a)(2)(i)(C)             | <input type="checkbox"/> 50.73(a)(2)(vii)    |
| <input type="checkbox"/> 20.2201(d)         | <input type="checkbox"/> 20.2203(a)(3)(ii)  | <input type="checkbox"/> 50.73(a)(2)(ii)(A)            | <input type="checkbox"/> 50.73(a)(2)(vii)(A) |
| <input type="checkbox"/> 20.2203(a)(1)      | <input type="checkbox"/> 20.2203(a)(4)      | <input type="checkbox"/> 50.73(a)(2)(ii)(B)            | <input type="checkbox"/> 50.73(a)(2)(vii)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i)   | <input type="checkbox"/> 50.36(c)(1)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(iii)              | <input type="checkbox"/> 50.73(a)(2)(ix)(A)  |
| <input type="checkbox"/> 20.2203(a)(2)(ii)  | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x)      |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2)        | <input type="checkbox"/> 50.73(a)(2)(v)(A)             | <input type="checkbox"/> 73.71(a)(4)         |
| <input type="checkbox"/> 20.2203(a)(2)(iv)  | <input type="checkbox"/> 50.46(a)(3)(ii)    | <input type="checkbox"/> 50.73(a)(2)(v)(B)             | <input type="checkbox"/> 73.71(a)(5)         |
| <input type="checkbox"/> 20.2203(a)(2)(v)   | <input type="checkbox"/> 50.73(a)(2)(i)(A)  | <input type="checkbox"/> 50.73(a)(2)(v)(C)             | <input type="checkbox"/> OTHER               |
| <input type="checkbox"/> 20.2203(a)(2)(vi)  | <input type="checkbox"/> 50.73(a)(2)(i)(B)  | <input type="checkbox"/> 50.73(a)(2)(v)(D)             |  |

Specify in Abstract below  
or in NRC Form 366A

## 12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

Enrique Villar

TELEPHONE NUMBER (Include Area Code)

(856) 339 -5456

## 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☒ NO

## 15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

This report is being made in accordance with 10CFR50.73(a)(2)(iv)(A), "any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(A)..."

On April 21, 2011, at approximately 16:00, a manual reactor trip was initiated with reactor power level at approximately 89%. The manual reactor trip was initiated in response to a degraded Circulating Water (CW) system and in accordance with abnormal operating procedures. The CW system degradation was due to heavy detritus loading that affected the ability of CW traveling water screens (TWS) to operate, and the resultant loss of circulating water pumps.

The unit was returned to service on April 23, 2011, at 05:19 after the debris was cleared from the screens, condenser water boxes were cleaned and the established management criteria developed in the Operational and Technical Decision Making Process were met.

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### NARRATIVE

#### PLANT AND SYSTEM IDENTIFICATION

Westinghouse – Pressurized Water Reactor (PWR/4)

Circulating Water System / Condenser (KE/COND)

\* Energy Industry Identification System {EIS} codes and component function identifier codes appear as {SS/CCC}

#### IDENTIFICATION OF OCCURRENCE

Event Date: April 21, 2011

Discovery Date: April 21, 2011

#### CONDITIONS PRIOR TO OCCURRENCE

Salem Unit 1 was in Operational Mode 1.

No structures, systems or components were inoperable at the time of the discovery that contributed to the event. However, 12A circulating water pump had been removed from service for maintenance.

#### DESCRIPTION OF OCCURRENCE

Historically Salem Station has experienced high level of river detritus during the early Spring.

On April 21, 2011, at approximately 11:32, a unit power reduction was initiated to maintain the required condenser delta temperature within its limit. The power reduction was terminated at approximately 89% power at 12:37 when condenser delta temperature reduced below its limit.

On April 21, 2011, at approximately 14:26, 11A circulating water pump was removed from service to clean its water box due to excessive grassing as indicated by high differential pressure across its condenser water water box tube sheet {COND/ -}. With two (2) circulating water pumps out of service (11A and 12A), control room personnel implemented the abnormal operating procedure S1.OP-AB.CW-0001 "Circulating Water System Malfunction."

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**DESCRIPTION OF OCCURRENCE (cont'd)**

On April 21, 2011, within a two minute period from 15:58 to 16:00, two CW pumps (13A and 13B) were lost due to significant detritus impingement. At 15:58 13B circulating water pump had to be manually tripped due to greater than eight (8) feet differential pressure on its traveling screen, and at 16:00 13A CW pump automatically emergency tripped due a rapidly rising differential pressure (greater than 10 feet) across its traveling screen.

At 16:00, the licensed control room operator manually tripped Salem Unit 1 as a result of four (4) out of six (6) circulating water pumps being out of service in accordance with S1.OP-AB.CW-0001 requirements.

Following the reactor trip the unit was stabilized in Mode 3. All auxiliary feed water pumps were in service providing auxiliary feedwater to the steam generators. Steam generator levels were being controlled within the guidance of the emergency operating procedures. At 16:15, 13 steam generator level cleared its low level trip set point but subsequently water level dipped below its low level trip set point generating an auto start signal to the already running motor driven auxiliary feed water pumps. Similarly, at 16:40, 14 steam generator levels cleared its low level trip set point but subsequently water level dipped below its low level trip set point generating another auto start signal to the already running motor driven auxiliary feed water pumps. Neither one of these events had any effect on the unit stability or the ability of the auxiliary feedwater system to provide cooling flow to the steam generators.

Salem Unit 1 was returned to service on April 23, 2011, at 05:19 after condenser water boxes were cleaned and screens were demonstrated to operate properly.

This report is being made in accordance with 10CFR50.73(a)(2)(iv)(A), "any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(A)."

**CAUSE OF OCCURRENCE**

The manual reactor trip was performed in accordance with the requirements of the abnormal operating procedure as a result of the loss of circulating water pumps. The cause of the loss of circulating water pumps was attributed to abnormally high amounts of river detritus entrainment on the CW traveling water screens.

The river detritus levels in April 2011 were at historic high levels. The single sample peak measured at 16:53 on April 21, 2011 was 36,759 kg/million cubic meters. (This is approximately 18 times higher than the Alert Level criteria established in the Abnormal Procedure)

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## NARRATIVE

### CAUSE OF OCCURRENCE (cont'd)

Additionally, the duration of the 2011 high detritus period was longer than experienced in previous years. The longer duration resulted in an extended period of higher stress, and wear that contributed to accelerated degradation of circulating water screen equipment. The high detritus level for a long duration contributed to the inability to maintain sufficient number of circulators in service.

### PREVIOUS OCCURRENCES

A review of LERs at Salem Station dating back to 2003 identified three other occasions of a reactor trip due to unusual harsh environmental conditions. LER 311/2003-001 "Manual Reactor Trip Due to Degradation of Condenser Heat Removal," LER 272/2007-002 "Manual Reactor Trip Due to Degraded Condenser Heat Removal," and LER 311/2010-001 "Manual Reactor Trip Due to Degraded Condenser Heat Removal" were caused by excessive grassing. PSEG has taken a number of corrective and preventive actions to improve the reliability of the circulating water system. PSEG has also implemented predictive tools and measures to anticipate the period and severity of grass impingements. These actions and predictive measures have reduced the vulnerability of the circulating water system to these highly variable surges of heavy debris loading.

### SAFETY CONSEQUENCES AND IMPLICATIONS

There was no actual safety consequence associated with this event.

Operators appropriately responded to the degraded circulating water system (loss of circulating water pumps) and the potential loss of normal heat sink (condenser) by manually tripping the reactor in accordance with plant procedures. Plant response to the manual reactor trip was normal. All safety systems operated as required.

The generation of the additional start signals to motor driven auxiliary feedwater pumps had no effect on the stability of the Unit or the ability of the auxiliary feedwater system to provide cooling flow to the steam generators.

A review of this event determined that a Safety System Functional Failure (SSFF) as defined in NEI 99-02, Regulatory Assessment Performance Indicator Guidelines, did not occur. This event did not prevent the ability of a system to fulfill its safety function to either shutdown the reactor, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident.

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#### CORRECTIVE ACTIONS

1. The unit was returned to service on April 23, 2011, at 05:19 after the debris was cleared from the screens, condenser water boxes were cleaned and the system was demonstrated to operate properly. As a restart constraint, the Salem Management team provided management criteria to remove the Salem Unit 1 from service if detritus level in the river became unacceptable for continued safe operation. As a result of these conservative guidelines, Salem Unit 1 was removed from service (generator output breakers opened) on April 24, and May 1, 2011. Salem Unit 1 was kept off-line until May 3, 2011 at 16:31, when detritus level in the river became low enough to sustain safe operation of the unit.
2. A design change modification to reroute and extend the circulating water screen wash discharge further offshore is under review for implementation prior to the next spring detritus season. The purpose of this modification is to minimize the amount of debris that is returned to circulating water screens after being washed from the screens.
3. An evaluation is in progress; any additional corrective actions associated with this event will be tracked in the PSEG Corrective Action Program.

#### COMMITMENTS

No commitments are made in this LER.